WHAT IS CLAIMED IS:

Sub B1

1. A perpendicular magnetic recording head comprising: an auxiliary pole layer; a main pole layer; and a coil layer for providing a recording magnetic field to the auxiliary pole layer and the main pole layer, a front end face of the auxiliary pole layer and a front end face of the main pole layer being exposed at an opposing face of the perpendicular magnetic recording head opposing a recording medium, the front end faces being separated by a gap therebetween, the coil layer being located inward in the height direction from the opposing face, the perpendicular magnetic recording head writing magnetic data on the recording medium by a perpendicular magnetic field concentrated to the main pole layer,

wherein the perpendicular magnetic recording head further comprises a nonmagnetic layer formed on the main pole layer and a connection layer extending from the auxiliary pole layer and being magnetically connected with the main pole layer, the connection layer being located inward in the height direction from the opposing face, the coil layer surrounding the connection layer.

2. A perpendicular magnetic recording head according to Claim 1, further comprising a yoke layer for magnetically connecting the main pole layer to the connection layer.

3. A perpendicular magnetic recording head according to Claim 1, wherein the nonmagnetic layer comprises a nonmagnetic metal material.

Subpl cont

4. A perpendicular magnetic recording head according to Claim 3, wherein the main pole layer and the nonmagnetic layer are formed by plating.

5. A perpendicular magnetic recording head according to Claim 1, wherein the front end face of the main pole layer exposed at the opposing face has a width in the track width direction gradually increasing toward the top of the main pole layer.

6. A perpendicular magnetic recording head according to Claim 5, wherein the two sides of the front end face in the track width direction are tilted and are either straight or curved.

7. A perpendicular magnetic recording head according to Claim 5, further comprising a plating base layer comprising a magnetic material, wherein the main pole layer is disposed on the plating base layer, at least part of each of the two side faces of the plating base layer in the track width direction is extended beyond an end of the bottom face of the main pole layer in the track width direction, and the extended part is controlled to a predetermined width so that

the extended part does not protrude from the recorded track width Tw1 of the recording medium when a skew angle is generated during recording on the recording medium.

Subst Cont

8. A perpendicular magnetic recording head according to Claim 1, further comprising a plating base layer comprising a magnetic material, wherein the main pole layer is disposed on the plating base layer, the two side faces of the plating base layer in the track width direction and the two side faces in the track width direction of the main pole layer are on a continuous plane, the width in the track width direction of the top face of the plating base layer being equal to that of the bottom face of the main pole layer; and the width in the track width direction of the plating base layer either decreases or is maintained the same as the width of the bottom face of the main pole layer toward the bottom face of the plating base layer.

9. A perpendicular magnetic recording head according to Claim 1, further comprising a plating base layer comprising a nonmagnetic metal material, wherein the main pole layer is formed on the plating base layer.

10. A perpendicular magnetic recording head according to Claim 9, wherein the width in the track width direction of the plating base layer is larger than the width in the track width direction of the bottom face of the main pole

layer.

11. A perpendicular magnetic recording head according to Claim 2, wherein the saturation magnetic flux density of the main pole layer is higher than the saturation magnetic flux density of the yoke layer.

12. A perpendicular magnetic recording head according to Claim 2, further comprising an insulating layer embedding the coil layer, the insulating layer being disposed on the auxiliary pole layer and having the top face flush with the top face of the main pole layer,

wherein the yoke layer is formed on the top face of the insulating layer and the top face of the connection layer and has a front end face located inward in the height direction from the opposing face, and

wherein the main pole layer and the nonmagnetic layer extend from the top face of the insulating layer to the top face of the yoke layer, the nonmagnetic layer being disposed between the front end face of the yoke layer and the opposing face.

13. A perpendicular magnetic recording head according to Claim 12, wherein the front end face of the yoke layer tilts in the height direction toward the top of the yoke layer and is either flat or curved.

14. A perpendicular magnetic recording head according to Claim 2, further comprising:

a first insulating layer embedding the coil layer, the top of face of the first insulating layer being flush with the top face of the connection layer, the yoke layer being formed on the top faces of the first insulating layer and the connection layer, a front end face of the yoke layer being disposed inward in the height direction from the opposing face; and

a second insulating layer disposed between the front end face of the yoke layer and the opposing face, the top face of the second insulating layer being flush with the top face of the yoke layer,

wherein the main pole layer and the nonmagnetic layer extend from the top face of the second insulating layer to the top face of the yoke layer.

15. A perpendicular magnetic recording head according to Claim 14, wherein the front end face of the yoke layer tilts in the height direction toward the bottom of the yoke layer and is either flat or curved.

16. A perpendicular magnetic recording head according to Claim 12, wherein the area of the yoke layer is larger than the area of the main pole layer in a cross section taken at an overlapping region of the yoke layer and the main pole layer and in the direction parallel to the

opposing face.

17. A perpendicular magnetic recording head according to Claim 14, wherein the area of the yoke layer is larger than the area of the main pole layer in a cross section taken at an overlapping region of the yoke layer and the main pole layer and in the direction parallel to the opposing face.

18. A method for manufacturing a perpendicular magnetic recording head, the method comprising the steps of:

(a) forming an auxiliary pole layer using a magnetic material;

(b) forming a connection layer on the auxiliary pole layer at a position inward in the height direction from an opposing face of the perpendicular magnetic recording head opposing a recording medium, forming an insulating underlayer on the auxiliary pole layer between the opposing face and the connection layer, forming a coil layer on the insulating underlayer, and filling the space surrounding the coil layer with an insulating layer;

(c) milling the top face of the insulating layer so as to make the top face flush with the top face of the connection layer;

(d) forming a yoke layer on the insulating layer, the yoke layer extending up to the region above the connection layer, a front end face of the yoke layer being disposed

inward in the height direction from the opposing face;

(e) forming a plating base layer on the insulating layer and the yoke layer, forming a resist layer on the plating base layer, and forming an opening in the resist layer, the opening extending from the opposing face over the insulating layer and the yoke layer;

(f) sequentially forming by plating a main pole layer and a nonmagnetic layer comprising a nonmagnetic metal material in the opening and removing the resist layer; and

(g) milling the two side faces in the track width direction of the main pole layer and the two side faces in the track width direction of the nonmagnetic layer.

19. A method for making a perpendicular magnetic recording head according to Claim 18, wherein, in said step (g), a portion of the plating base layer not overlaid by the main pole layer is removed by milling.

20. A method for making a perpendicular magnetic recording head according to Claim 18, wherein said step (d) is omitted, and said step (e) includes forming a plating base layer on the insulating layer, forming a resist layer on the plating base layer, and forming an opening in the resist layer, the opening extending from the opposing face over the insulating layer and the connection layer.

21. A method for making a perpendicular magnetic

recording head according to Claim 18, wherein said step (e) is replaced by the steps of:

(h) filling the space surrounding the yoke layer with a second insulating layer, milling the top face of second insulating layer to make the top face flush with the top face of the yoke layer; and

(i) forming a plating base layer over the second insulating layer and the yoke layer, forming a resist layer on the plating base layer, and forming an opening in the resist layer, the opening extending from the opposite face over the second insulating layer and the yoke layer.

22. A method for making a perpendicular magnetic recording head according to Claim 18, wherein, in said step (e), the opening has a width in the track width direction increasing toward the top of the resist layer at least at the opposing face.

23. A method for making a perpendicular magnetic recording head according to Claim 20, wherein, in said step (i), the opening has a width in the track width direction increasing toward the top of the resist layer at least at the opposing face.

24. A method for making a perpendicular magnetic recording head according to Claim 18, wherein the plating base layer comprises a nonmagnetic metal material.